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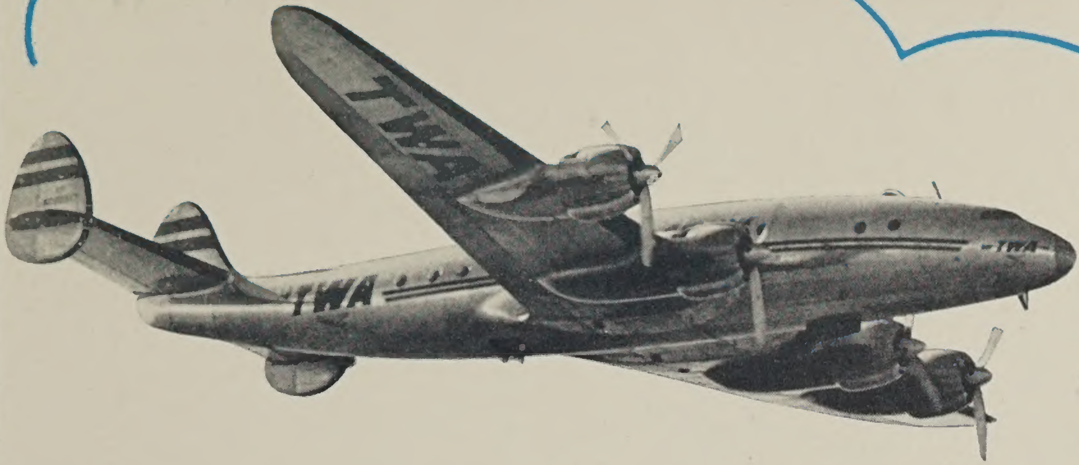
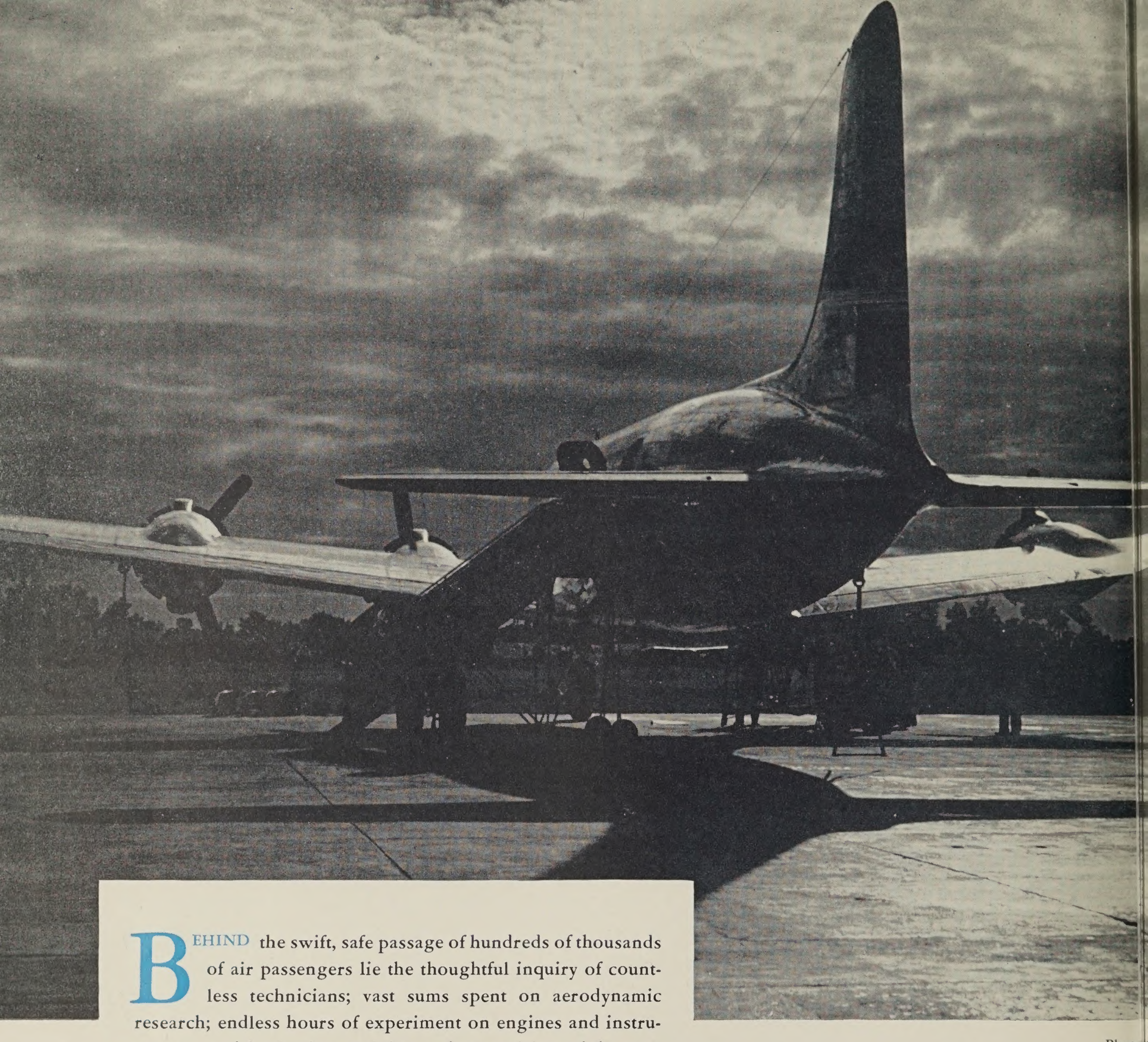


CONCRETE for Airports



Photo

BEHIND the swift, safe passage of hundreds of thousands of air passengers lie the thoughtful inquiry of countless technicians; vast sums spent on aerodynamic research; endless hours of experiment on engines and instruments; careful selection, training and supervision of the men and women who fit and man the ships. Safety must be assured.

Modern, massive airplanes need strong, durable concrete runways which aid in making quick take-offs and smooth, effortless landings. Safety at the take-off and when landing is the obvious complement of safety in the air.

Front Cover—Lockheed Constellation. Photo courtesy Lockheed Aircraft Co. Toledo Airport, Toledo, Ohio.

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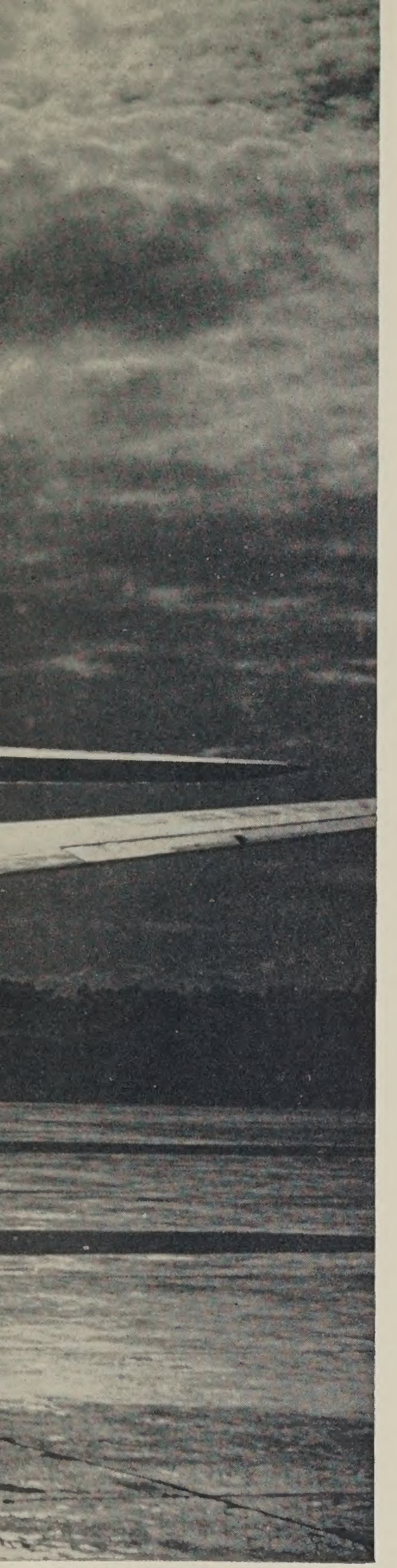


tesy Chicago & Southern Airlines.

A MESSAGE TO ALL those vitally interested in the development of major and intermediate airports*: *For safety, economy and comfort, portland cement concrete is the best material for runways, taxiways and aprons.* Here are the reasons why:

Concrete airport pavement aids flying safety—

1. It has high visibility.
2. It has high skid-resistance.
3. It has a low crown.
4. It is free from loose particles.
5. It makes take-offs and landings easier.

Concrete airport pavement is economical—

1. It can be designed to carry any weight of plane.
2. It has a long life.
3. Its maintenance cost is low.
4. It is easy on equipment.
5. It saves in lighting costs.
6. It permits maximum pay loads.

For these reasons, and because concrete assures comfortable, shockfree, pleasant landings, it is the airport pavement preferred by passengers, pilots and management.

**For secondary municipal and auxiliary military airports and for mass take-off areas, temporary and emergency runways and parking areas, soil-cement offers a durable light-duty pavement at low cost. Write us for complete information.*

At night, or when visibility is low, concrete's high light-reflective value is an important aid to safe flying. Also, the cost of runway lighting is greatly reduced when modern, safe concrete is used. Photo courtesy Northwest Air Lines.

CONCRETE

has high

WE see objects by light which is reflected from them to our eyes. Measurement of reflection by skilled observers with scientific equipment has shown that concrete reflects several times as much light as is reflected from dark-colored pavements. This means that the pilot sees a concrete runway several times better. High visibility facilitates depth perception, too—an all-important factor in the landing process. This is always desirable; but when the margin of safe visibility is low, it is of supreme importance.

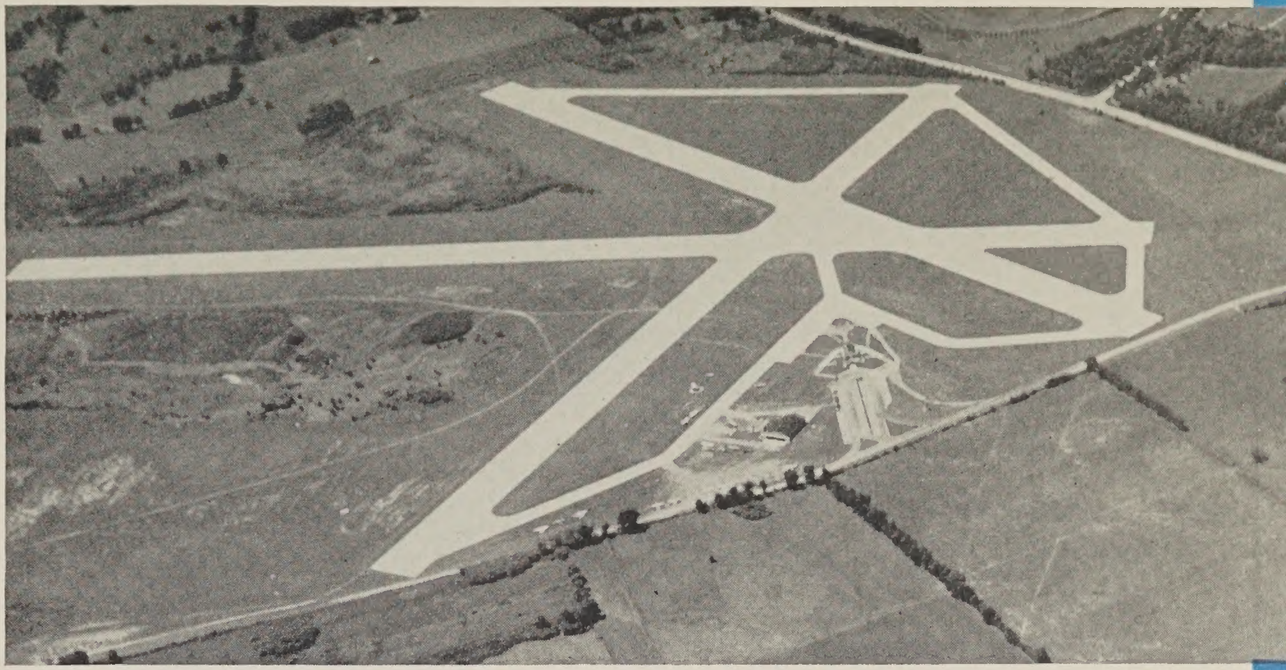
Concrete has a highly desirable matte surface. Light striking it is diffused, is visible in all directions. This is in sharp contrast to light reflected from specular (shiny) surfaces which may have a glaring intensity in one direction but, in other directions, may have such low intensity as to be almost invisible.

Pilots can spot concrete runways from as far as 40 miles. Especially at night, concrete's light color makes it easier for the pilot to pick up the runways and see them clearly as he lands.

●

Heavy planes landing at high speeds must have skid-resistant surfaces so that the brakes can stop them within the length of the runway. If one wheel skids while the other holds, a ground loop is the probable result. Nose-overs and other accidents may be caused if uniform skid-resistant surfaces are not provided.

Concrete's gritty texture gives ample and uniform grip to the tires. While all paved surfaces cause some wear on tires in landing, concrete runways can be built to reduce wear to a minimum. Any degree of surface grittiness desired can be obtained with concrete. And



This unretouched photograph of the Bluegrass Airport, Lexington, Ky., leaves no doubt about the high visibility of concrete for runway pavement.

visibility . . . skid-resistance . . . low crown

just as important—concrete retains this uniform, skid-resistant quality for many years.

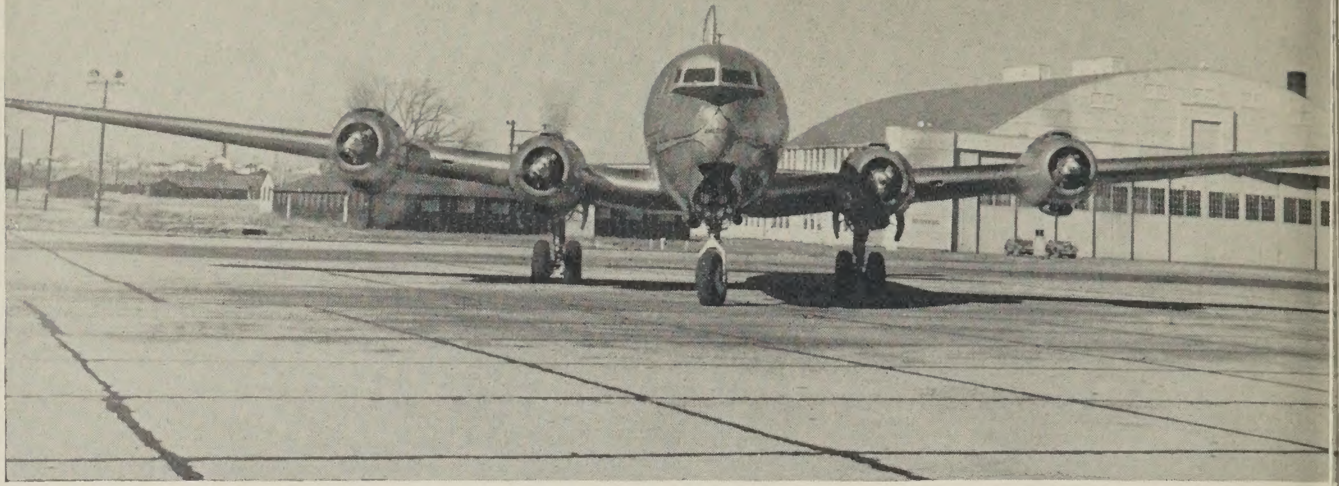
●

Crown is given to pavement to insure drainage. It should be kept as low as possible and still insure rapid and complete runoff of rainfall. With some materials and methods of construction, adequate drainage is difficult to obtain. Such runway pavements must be given high crowns to avoid water pockets made by depressions. This is not true of concrete. It is laid accurately to specified grade and crown and its true surface insures rapid and complete runoff.

The low crown which may be used on concrete reduces the tendency of planes to veer toward the edge of the runway and away from a straightaway course. It is a major factor in safe take-offs and landings.

Tires of a landing plane grip concrete evenly and surely; its low crown assures quick and complete runoff of rainfall. Concrete is not injured by oil drippings or spilled gasoline. Photo courtesy Northwest Air Lines.

When a pilot "revs" his engines preparatory to taking off, concrete contributes no loose stone chips or pebbles to damage equipment or injure passengers. Nor will the turning action of the wheels damage the concrete as he swings the plane into the take-off position. Photo courtesy American Airlines.



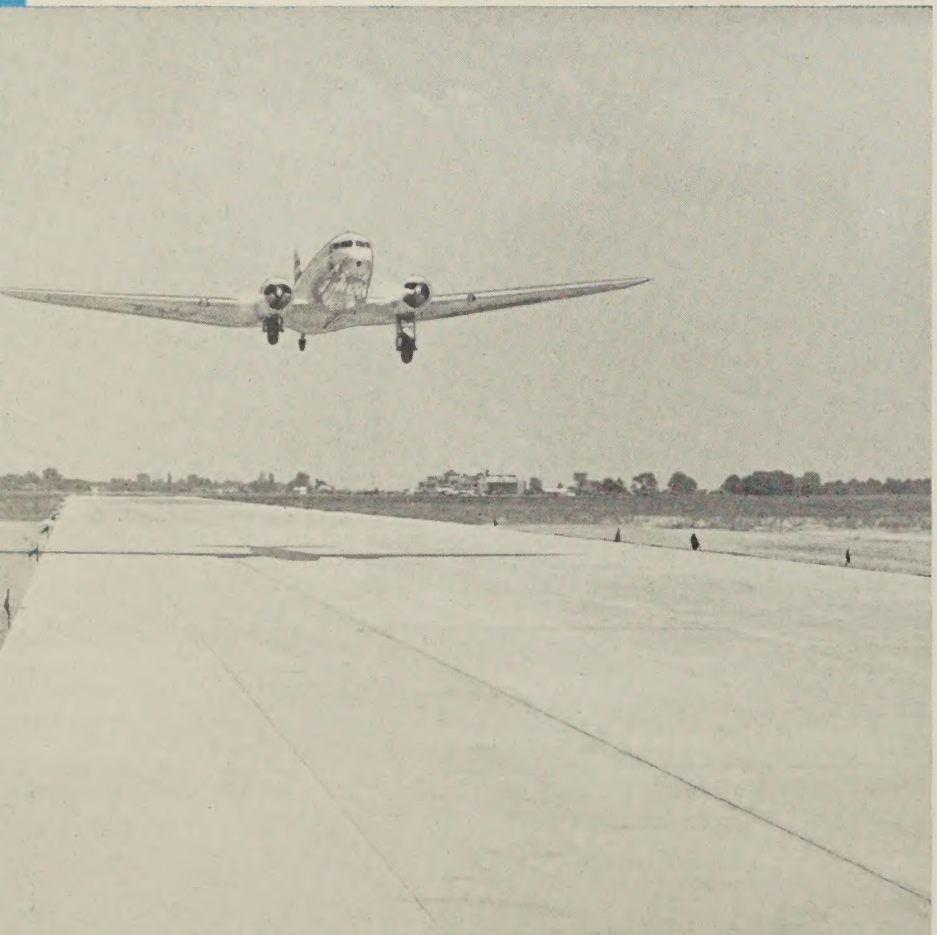
CONCRETE *is free from loose particles*

Dust and dirt on airport runways are annoying to passengers and personnel. But loose chips and pebbles are a serious menace to flying safety.

Picked up by the propeller stream when the engines are "run-up" before the takeoff, they are thrown with great force against propeller tips, engine cooling fins or control surfaces of the plane. People have been injured by them.

Even a small nick in the propeller tip caused by a flying pebble may have serious results after the flight is underway. The best of maintenance cannot insure propellers against being damaged in this way. The damaged propeller may set up vibrations severe enough to tear the engine from the plane. This damage to propellers is not a theoretical danger but one which caused, in a recent two-year period, 18 per cent of all accidents due to power plant failures. With concrete, no loose stone chips or pebbles endanger flying safety.

CONCRETE *makes take-offs and landings easier*



An airplane rolls easily over concrete runways because of their rigid, even surface. There is a minimum of rolling friction. The plane gets into the air quickly, clearing obstructions at the edge of the airport with a greater margin of safety than would be possible with an uneven surface having a higher rolling friction.

Planes starting from concrete runways can get into the air with a maximum load. This means that on long flights there will be less danger of forced landings due to exhaustion of the fuel supply.

In landing on concrete the pilot is assured that there will be no surface irregularities to trouble him.

On concrete runways the plane is in flight in minimum time. There are no bumps to jostle passengers. Before they realize it, they are airborne.

CONCRETE *is the economical airport pavement*

CAN BE DESIGNED FOR ANY PLANE WEIGHT

NOT so many years ago, when planes were small and few in number, little thought was given to adequate strength of runways. But tremendous forward strides have been made in air transport. Both in weight and numbers, commercial and military planes have increased at an amazing rate. At major airports several hundred planes of all classes take off and land daily. Planes built or planned weigh up to more than 300,000 lb. Pavement of substantial strength is required to carry such heavy wheel loads.

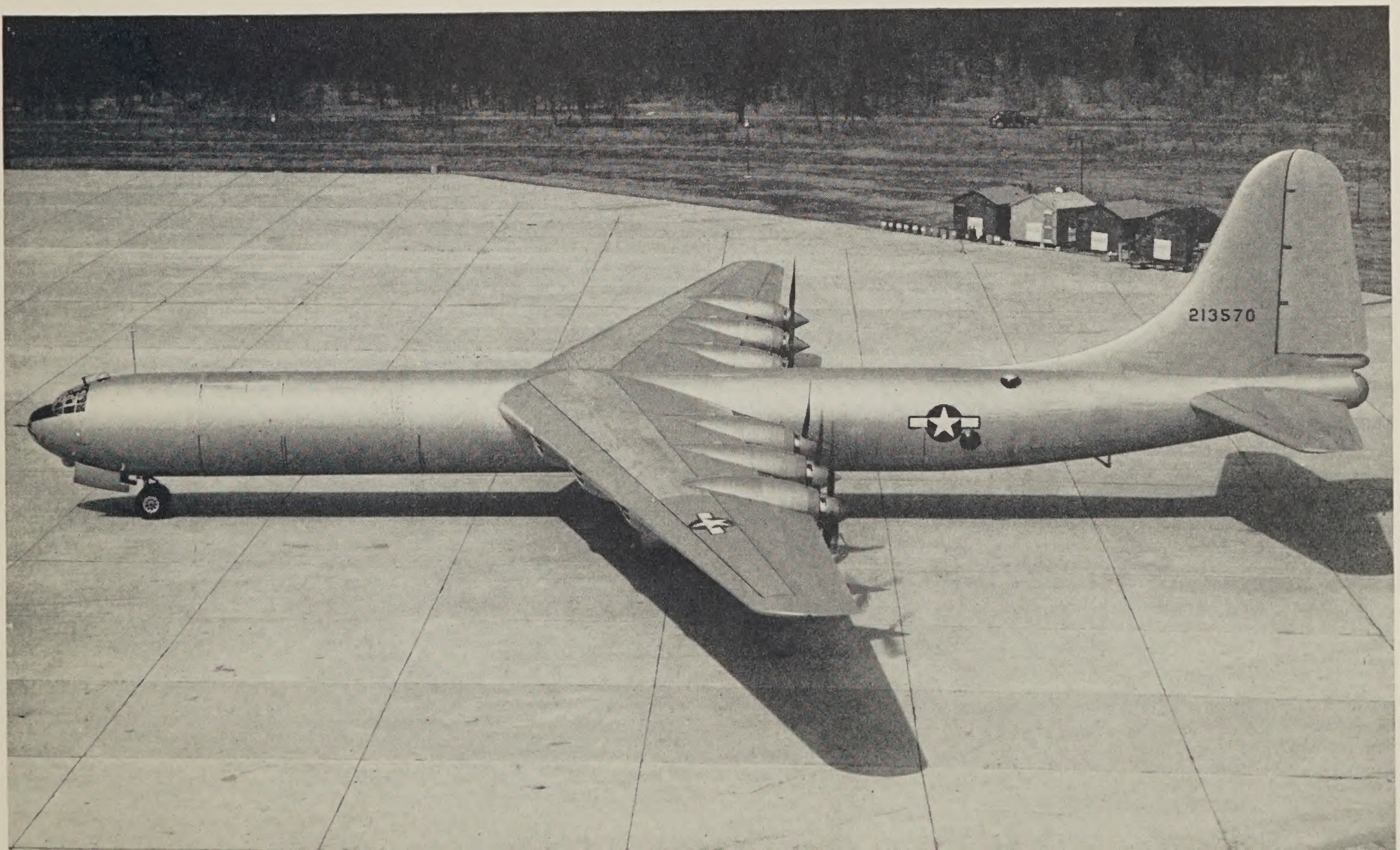
Just how strong should a runway be? If not strong enough, it may fail prematurely under traffic or require excessive repairs to keep it in service. If too strong, the first cost is greater than necessary. For economy, the pavement should be designed to fit anticipated loads.

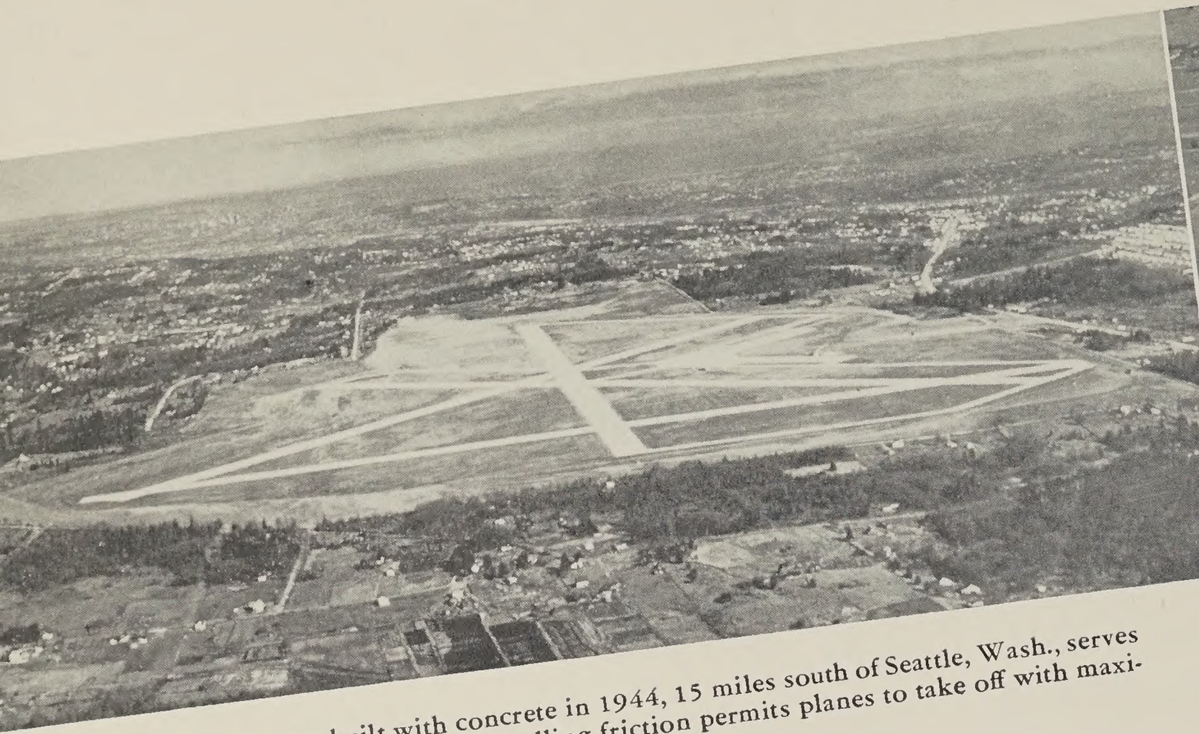
This is possible with concrete. Theoretical analyses, experimentation and field experience have led to the development of design procedures that insure adequate capacity without wasteful overdesign.

Under all but the most exceptional conditions the first cost of concrete pavement, properly designed, will be less than that of any other type of surface having equal carrying capacity. Cheaper surfaces, of less carrying capacity, may be constructed. But short life and heavy maintenance costs which result from their inadequacy will make them more expensive in the long run.

That concrete has the lowest *annual cost* has been demonstrated over and over.

Here is Consolidated's huge B-36, 168-ft. long giant of the air. This sleek bomber is truly indicative of things to come in aircraft design . . . and the 300,000-lb. weight shows what loads may eventually be encountered. Built to specifications, concrete efficiently accommodates such loads as those applied by the B-36. Concrete is the surface to serve the loads to come.





Bow Lake Airport, built with concrete in 1944, 15 miles south of Seattle, Wash., serves both Seattle and Tacoma. Its low rolling friction permits planes to take off with maximum loads.

The United States Naval Air Station, G
"mats" and the system of runways. Her
Official photograph, U.S. Navy.

Concrete

HAS LONG LIFE

Concrete airport runway pavements have already been in use long enough to prove that they have the strength and durability to give long years of useful service. Runways up to 12 years old give little evidence of the passage of the years. What their ultimate useful life will be can be determined from highway service records.

These records show that concrete pavement has a useful life expectancy of 25 to 30 years. With today's improvements in design and construction, an even longer useful life can reasonably be expected.

Long life is a principal reason for the growing acceptance of concrete runways. At many airports other types of runways have proved inadequate to carry modern air traffic. After only a few years they have had to be rebuilt. Some of them have been rebuilt with concrete to avoid expensive reconstruction.

COSTS LESS TO MAINTAIN

When properly designed and built, concrete airport pavement will carry current and anticipated traffic for many years with freedom from those structural failures that require costly repairs and reconstruction. Concrete does not need periodic retreatment or resurfacing. Upkeep will usually be limited to sealing joints.

Some airport managers report that
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TO LIGHT

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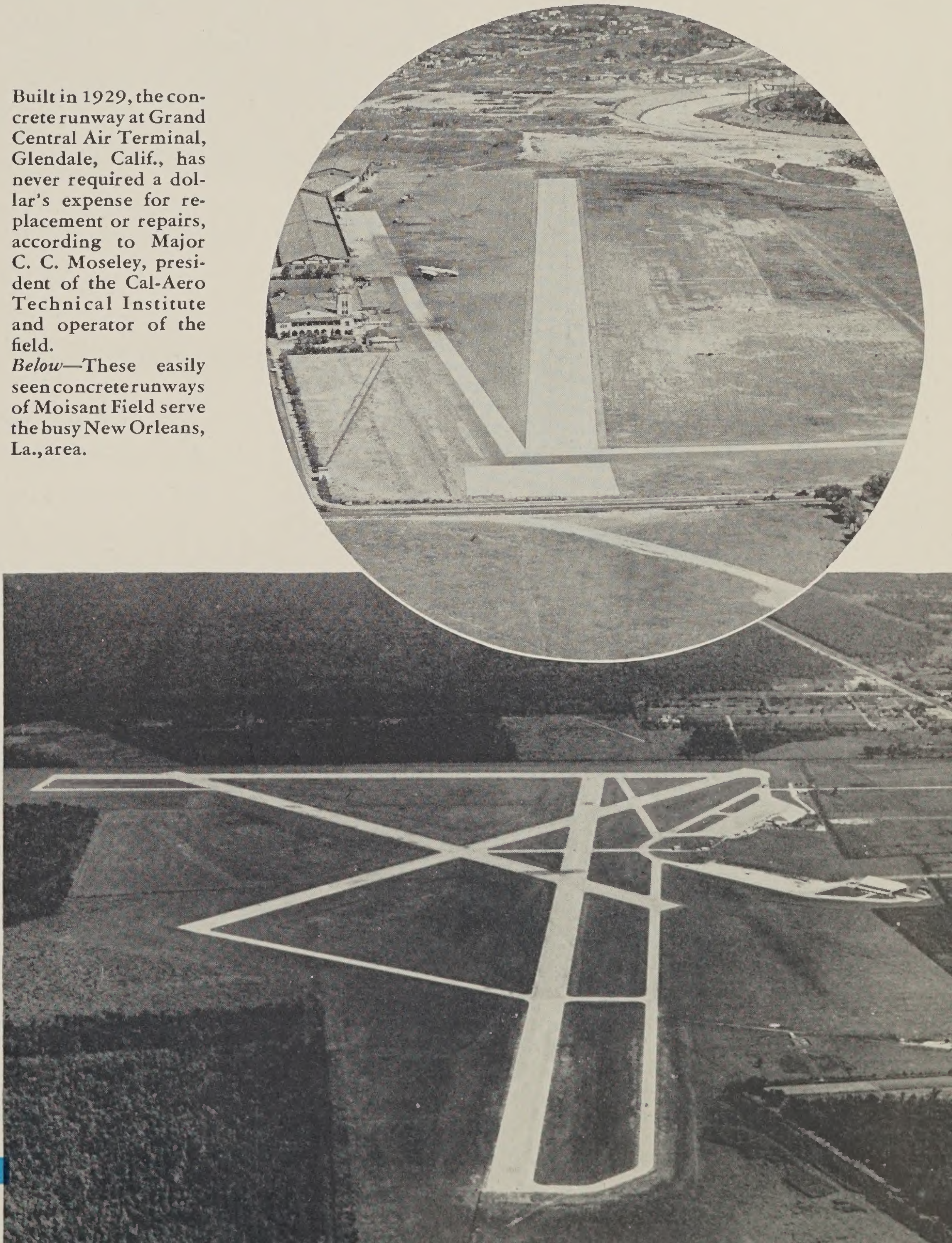
a published report of a lighting expert covering an incident at a large western airport. A satisfactory lighting installation became entirely inadequate when light-colored runways were covered with dark oil. An increase of more than 70 per cent in lighting only partially restored the efficacy of the lighting system.

PERMITS MAXIMUM PAY LOADS

The same low rolling friction of concrete which enables either commercial or military planes to get into the air quickly also helps them to get off with full load of fuel and maximum cargo. There is less probability of having to leave part of the load behind or of having to put on an additional flight to handle it. Here, also, concrete runways mean increased economy.



Built in 1929, the concrete runway at Grand Central Air Terminal, Glendale, Calif., has never required a dollar's expense for replacement or repairs, according to Major C. C. Moseley, president of the Cal-Aero Technical Institute and operator of the field.
Below—These easily seen concrete runways of Moisant Field serve the busy New Orleans, La., area.

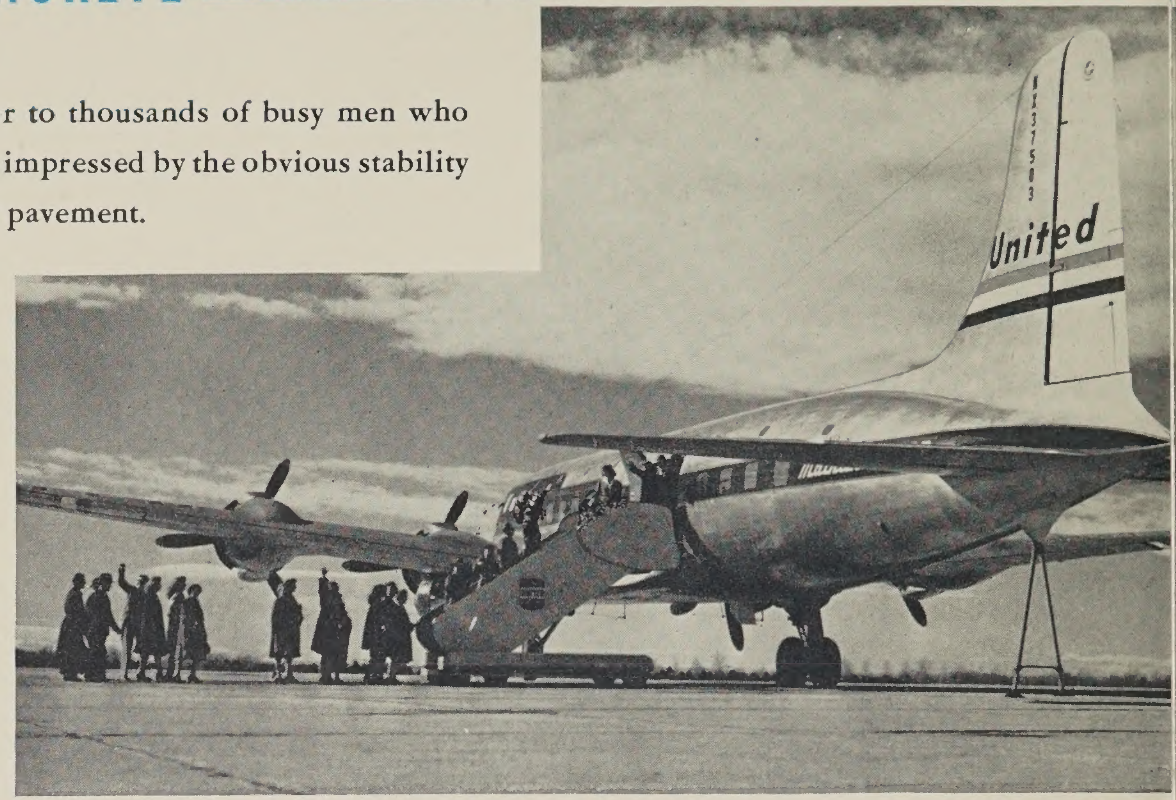
Passengers like CONCRETE

THE airport is a city's front door to thousands of busy men who travel by air. They are favorably impressed by the obvious stability and permanence of concrete airport pavement.

They like the cleanliness of concrete.

They like its high visibility as they approach an airport. It gives them a feeling of security, of a safe harbor awaiting them.

Then there is the effortless, smooth landing. Bumps and bounces are at a minimum when the landing is on concrete. Almost before they realize it the plane has taxied swiftly up to the platform.



Passengers are assured that concrete makes their flight more pleasant, the take-off and the landing more safe, comfortable and shock-free. Photo courtesy United Air Lines.

Photo courtesy United Air Lines.

Management likes CONCRETE

AIRLINE operators and airport officials like concrete because it aids safety and they know that accidents cost good will, human lives—and money.

They like the light color of concrete with its ease of lighting and greater visibility.

The airport official likes concrete because its maintenance cost is low. He knows that with concrete he will not have to rebuild or resurface every few years.

Management likes concrete airport pavement because of its cleanliness, durability and dependability. With operators using the best flying equipment available, it is false economy to operate these planes on anything but the best airport pavement.

The entire layout of concrete pavement for runways, aprons and taxiways at an airport of moderate size may actually cost less than *one* modern transport plane.

Management knows that in addition to being the best, concrete actually costs less per year.

Pilots like CONCRETE

"CONCRETE is much easier to see at any time and is tremendous help in bad weather landings. All landings and take-offs are smoother and safer on concrete." "Concrete provides much better braking surface wet or dry. Is better for night operations. Does not develop 'chug holes'." These are just two quotes of many from the men who fly—the airline pilots. Airports are a tool of the trade for them, so their earnest interest in the surfacing of runways and aprons is only natural. In a poll to determine opinions on airport surfaces, *46 out of 47* pilots expressed their preference for concrete as the best runway surface.

The pilot who takes off or lands on concrete runways is free to devote his entire attention to the plane. He doesn't have to worry about skidding, about water pockets, loose stone chips, irregularities in the pavement surface. He knows that the pavement is completely adequate.

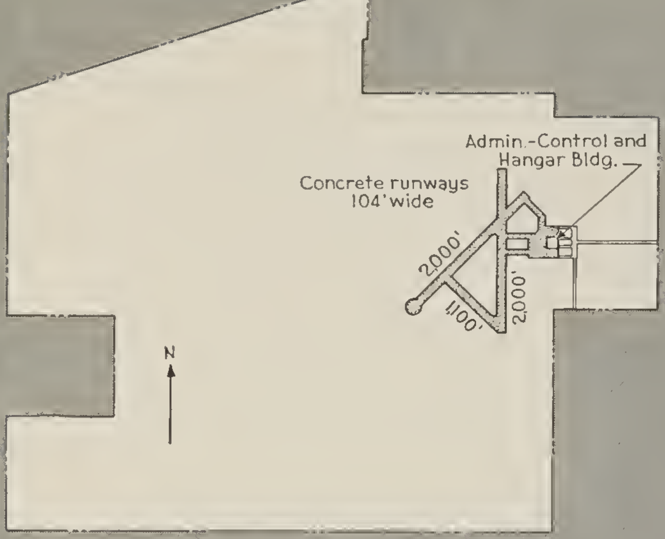
He appreciates its high visibility—a factor of first importance. Even the layout of joints helps him judge his altitude accurately, a difficult feat on surfaces uniform in color. The "ladder effect" of the transverse and longitudinal joints of concrete pavements gives just the needed perspective so that errors in judgment are avoided in landing.

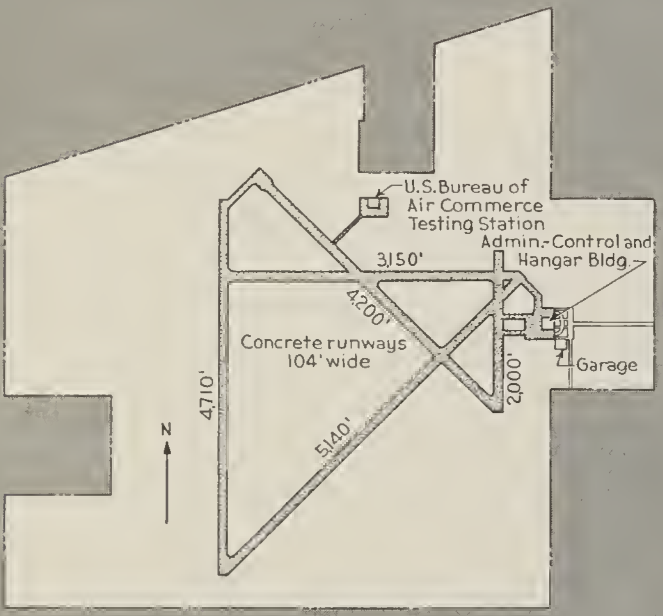
Experienced pilots know that so-called "resilient" surfaces have no practical cushioning effect when landing—that the cushioning effect supplied by any pavement surface is negligible compared to that provided by the plane's tires and shock absorbers.

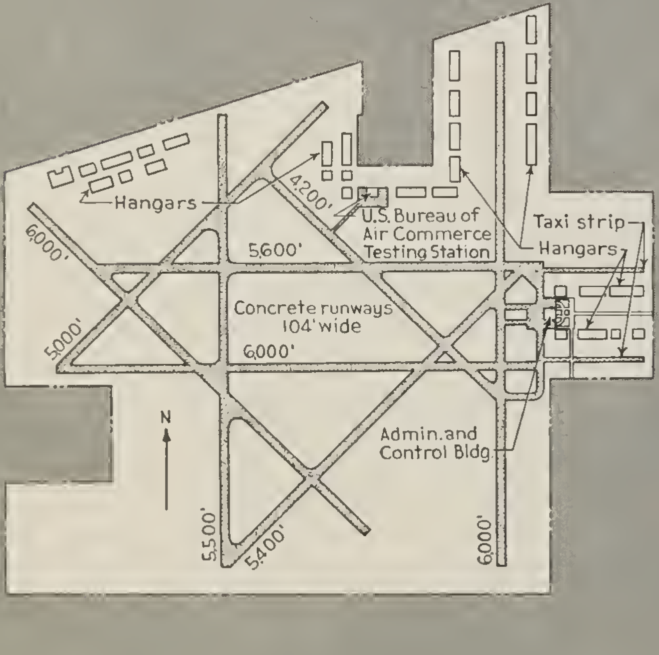
Pilots like concrete pavement because it helps them to operate their planes with safety, comfort and economy.

Photo courtesy American Air Lines.

Wichita, Kan., Municipal Airport, paved with long-lasting, safe concrete.







At the start, Indianapolis (see sketches at *left*) adopted a sound engineering plan for development of its airport. The plan embraced construction of runways, as needed, with low-annual-cost concrete. Thus, expensive reconstruction of temporary surfaces was avoided—maintenance cost was held to a minimum. Funds thus saved were available for new construction as needed to follow through on the original plan. *Top:* The first concrete runways built under the plan. *Center:* Current status of the runways. *Bottom:* Indianapolis Airport when the plan is completed.

PLAN AND BUILD

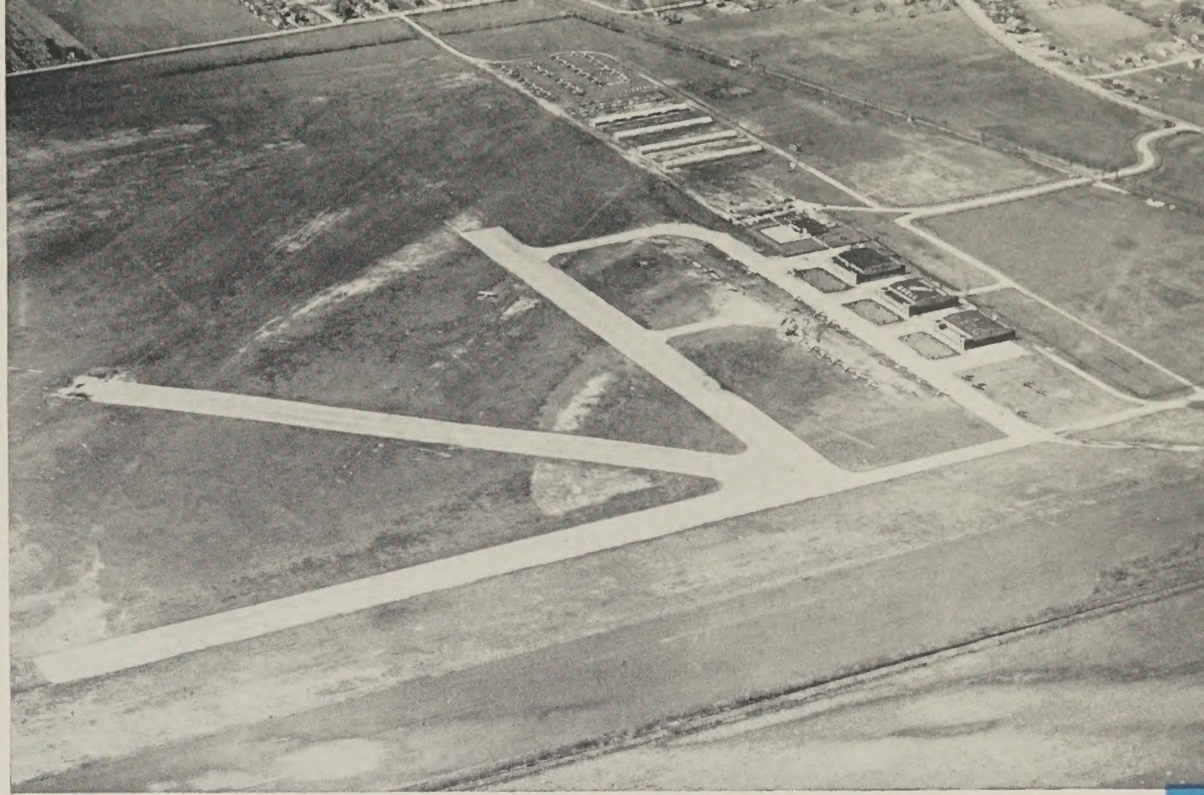
DURING the next few years there will be a large expansion of airport facilities. Construction of these facilities should be carried out as part of a sound engineering and economic plan providing for the ultimate complete development of the airport.

Use of inferior or inadequate materials does not fit into any such planned program. For example, runways which require excessive maintenance or which have to be rebuilt every few years are not economical. On the other hand concrete runways are. Savings in maintenance and reconstruction costs made possible by using concrete will help finance new construction.

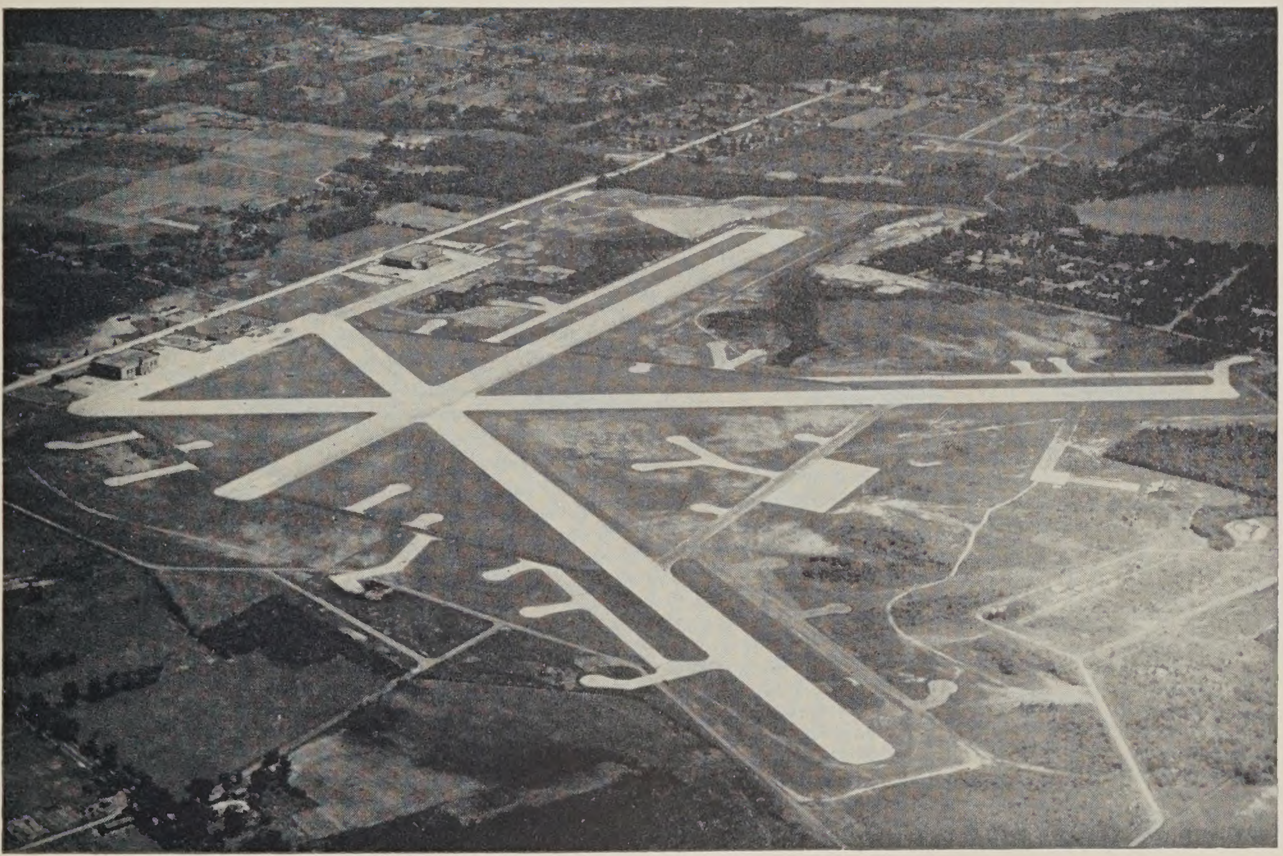
If traffic does not justify doing the whole job at once, step-by-step construction—followed at many airports—is the logical financial and engineering procedure. The important thing is to build into airport pavement those advantages which concrete supplies so that each new piece of construction fits in place in the ultimate plan.

A forward-looking plan aimed to provide adequate facilities as they are needed at the lowest annual cost is essential to economical airport development.

FOR THE FUTURE

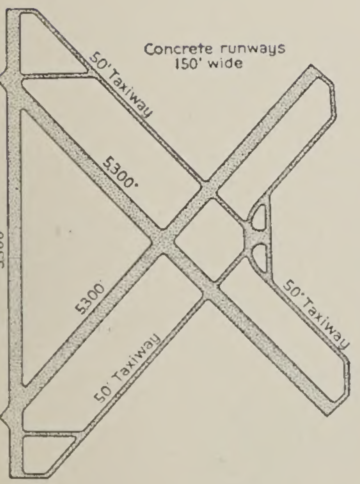


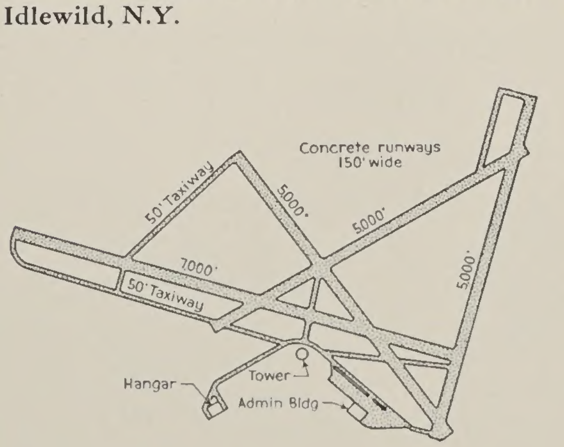
Curtis-Parks Airport, East St. Louis, Ill., is an up-to-date example of a Class I airport. These 1,600-ft. long runways serve lighter planes economically and safely.

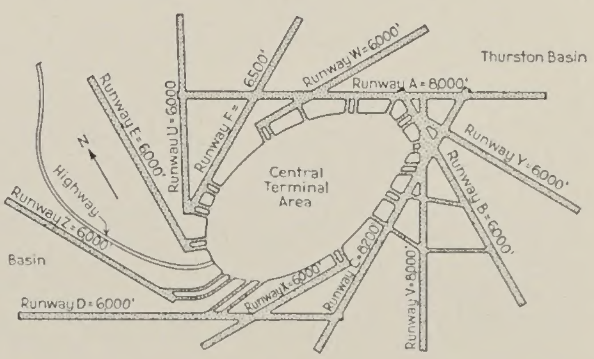


The Rhode Island State Airport in Hillsgrove, R.I.

Three sketches showing typical airports designed to serve varying traffic volumes. Advance planning insures adequate facilities to serve anticipated traffic. *Left:* University of Illinois Airport, Champaign, Ill. *Center:* Moisant Field, New Orleans, La. *Right:* The Port of New York Authority Airport at Idlewild, N.Y.







Administration building at Long Beach, Calif., Municipal Airport.

Administration Building of Washington National Airport, Washington, D.C.

ARCHITECTURAL CONCRETE

meets tempo of modern flying

Modern airport buildings should be resistant to fire and storm, economical to construct and maintain, pleasing in appearance and long-lived. Architectural concrete is the modern construction material for modern airport buildings, large and small.

Sleek and trim as the great silver airliners which it serves, architectural concrete catches the fluidity and moving design suggested by speed and forms it into graceful lines and masses. Architectural concrete buildings leave pleasing impressions with air-minded men.

Flight hanger at Buffalo Municipal Airport.

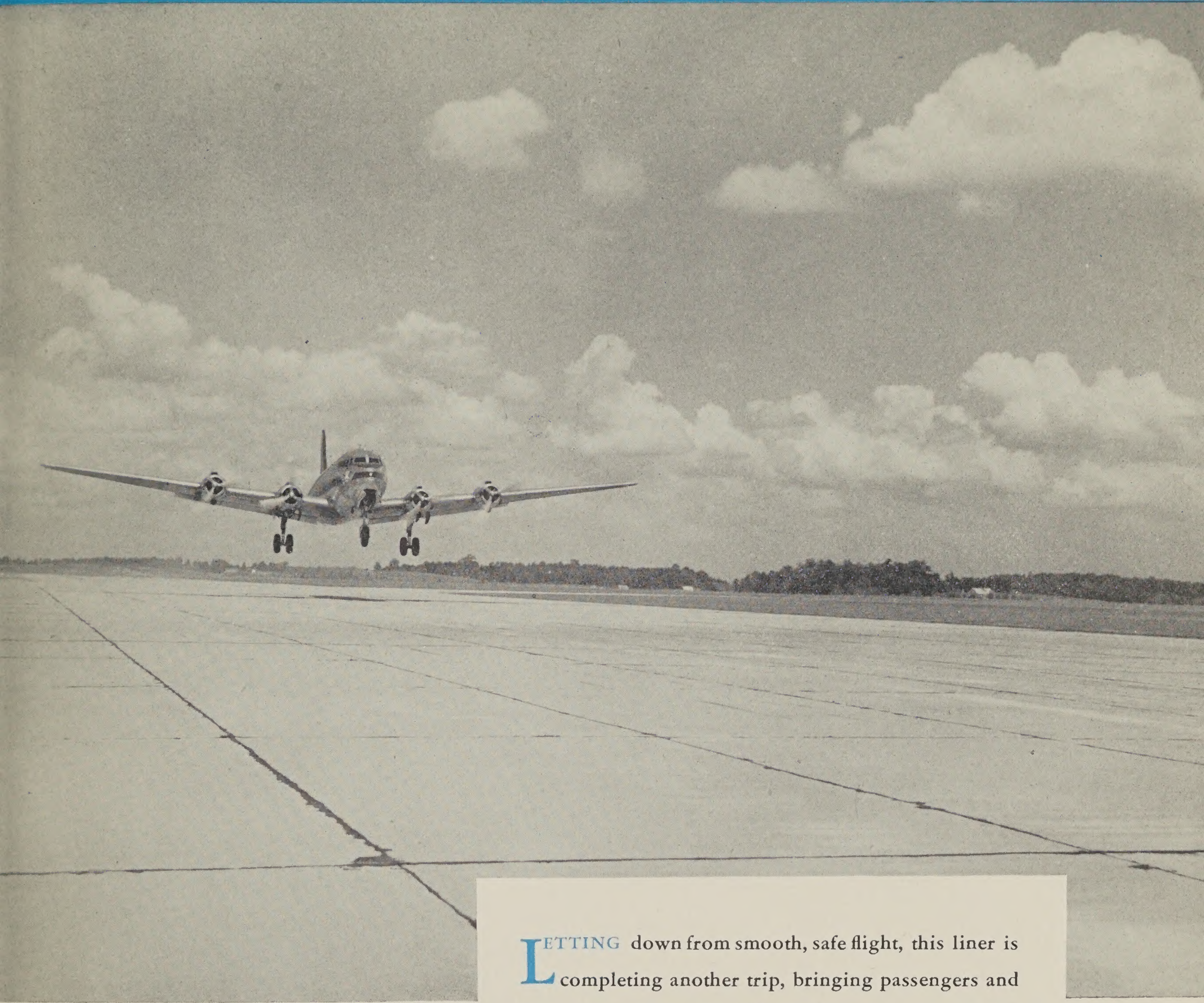


Photo courtesy Delta Air Lines.

Coming in—**SAFELY!**

LETTING down from smooth, safe flight, this liner is completing another trip, bringing passengers and cargo to a safe, comfortable landing.

Safety is foremost in all the varied phases of aviation, and the bright, level and lasting concrete runway is the obvious ground complement to safety in the air.

Take-offs and landings, highly important in the complete air transport process, are safest, easiest and most comfortable on concrete. Go to the pilots for expert opinion on the best airport surface. The overwhelming answer will be *concrete*—Safe—Economical—Long-Lasting.

Photo courtesy
TWA Air Lines.

Send now for these quick aids to better airport development

THE Portland Cement Association through its district offices has available for immediate distribution up-to-the-minute information on how to get the best results from cement and concrete in airport construction. Booklets, manuals, information sheets and detail drawings relating to airport development are available without obligation to airport officials and engineers. Write today to our district office nearest you, stating your particular problem. Material is available on the following subjects:

AIRPORT PAVEMENT. Includes rational design of concrete pavements, control of concrete mixtures, proportioning of concrete materials, discussion of design of concrete runways, inspection during construction and low maintenance cost of concrete roadways.

ARCHITECTURAL CONCRETE. Includes valuable design, form and construction details and many suggestions on how to secure beauty, economy and firesafety in architectural concrete buildings.

STRUCTURAL CONCRETE. Gives design and construction data on reinforced concrete for frames, walls and floors of hangars, administration and other buildings large and small; covers rigid frame, tied-arch and Z-D systems.

CONCRETE MASONRY CONSTRUCTION. Covers economical design and construction of firesafe structures built with precast concrete units, and ways to obtain beautiful interior and exterior textures and finishes on walls.

CONCRETE FLOORS AND SIDEWALKS. Presents basic data on economical design and construction of concrete floors and sidewalks applicable to airport use.

CONCRETE PIPE. Practical facts explaining how strong, durable concrete pipe effectively drains subgrades—prerequisite to planned airport development.

SOIL-CEMENT. Details of testing and field uses of soil-cement pavement.

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Kansas City 6, Mo.	1627 Dierks Bldg.
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